BERMUDA

REPORT

OF THE

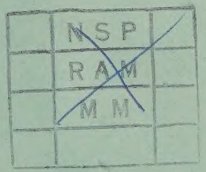
DEPARTMENT

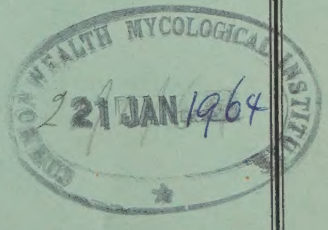
OF

AGRICULTURE

FOR THE YEAR

1950





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BOARD OF AGRICULTURE, 1950.

Messrs. H. St. George Butterfield, M.C.P. Chairman.
C. Vail Zuill, Deputy Chairman.

Ford Baxter	E. H. Barnes, M.C.P.
L. R. Selley	Abel Benevides
S. John Pye	Edward H. Simons

Lt. Col. J. C. Astwood, O.B.E., M.C.P.
The Hon. Sir Howard Trott, C.B.E.

DEPARTMENT OF AGRICULTURE, 1950.

Civil Service List

Director of Agriculture:	W. R. Evans
Assistant Director of Agriculture:	G. R. Groves
Agricultural Assistant:	C. V. S. Early
Inspector of Produce:	T. A. Hollis
Horticulturist:	C. A. Baker
Assistant Horticulturist:	G. D. Paley (Acting) (w.e.f. 16th. March, 1950).
Clerk, Board of Agriculture:	Mrs. Marguerite J. Speed (to 30th. June, 1950). Mrs. Helen W. Morrison (Acting) (w.e.f. 1st. July, 1950).
Plant Pathologist:	E. C. G. Bedford, B.Sc., M.Sc., (Protoria) to 24th. July, 1950).
Government Veterinary Officer:	Edward R. Earl, V. S., B.V.Sc.

Not on Civil Service List

Marketing Officer:	J. H. Hollis
Assistant Marketing Officer:	Carlyle Hollis
Accountant:	D. C. Eldridge (to 6th. May, 1950). Miss Amy DeSilva (Acting) (w.e.f. 7th. May, 1950).
Office Assistant:	Mrs. Helen W. Morrison (to 30th. June, 1950).

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Report of Director of Agriculture For the Year 1950.

The Chairman,
The Board of Agriculture.

I have the honour to submit reports on the activities of the Department of Agriculture for the year 1950 in accordance with the provisions of the Agriculture Act, 1930.

GENERAL AGRICULTURAL CONDITIONS.

Weather conditions during the year were more favourable for farming than in many years past. Successive crops of vegetables were harvested without appreciable damage from heavy winds and the rainfall was fairly evenly distributed over the crops seasons to permit sustained growth without check by the lack of soil moisture. These favourable conditions were markedly reflected in the cropping of tomatoes which fruited heavily throughout the year without any appreciable loss of fruit through blossom en-rot — a troublesome condition in years of uneven rainfall.

The programme of "Planned Production and Marketing" launched in the Fall of 1949 was piloted through its first year of operation fairly successfully. The transaction of business through the Government Wholesale Marketing Centre was greatly enhanced by the increased volume of vegetables produced by registered farmers on contract for the Government — an arrangement designed to prevent over production and the consequent loss of vegetables through deterioration. While the programme of "Planned Production and Marketing" has passed its initial test, its future progress rests with the producers, for whose benefit it was conceived.

AGRICULTURAL STATION.

A tremendous effort was made during the year to improve the usefulness of the Agricultural Station from a botanical aspect.

The "Forestry Centre" which was partly constructed in 1949 was completed early in the year and its usefulness in providing shade and shelter for the thousands of plants which have been propagated for reafforestation purposes was amply demonstrated during the year.

No. 2. Slat House now named "Nursery Centre" was completely rebuilt during the summer months and it now provides an attractive place where thousands of seedling trees and shrubs may be grown under favourable conditions.

The Orchid House has been enhanced with scores of new plants during the year. The House has become a much visited part of the Agricultural Station and many favourable comments have been received from visitors from abroad who appreciate finding orchids blooming under conditions closely resembling their natural habitat.

The Oleander found a place of honour at the Agricultural Station during the year. During the Summer months an Island-wide exploration was made with the view of collecting all of the different types of Oleanders that grow in the Colony. Cuttings were taken from 130 bushes bearing flowers of distinctive types. Some forty stands of Oleanders now adorn a hill situated West of Montrose House which in future will be known as "Oleander Hill". It is hoped eventually to have all the types of Oleanders growing in Bermuda represented in this group and plans are being made to give them appropriate local names.

The Hibiscus has also gained a place of honour in the Grounds of the Agricultural Station during the year. Over one hundred new varieties of choice Hibiscus were introduced from abroad together with the local existing ones make an impressive collection of great interest.

The Field Experiments conducted at the Agricultural Station which are fully reported upon by the Assistant Director should prove of considerable value to the Colony in the years to come. Through pressure of other work these essential experiments have been long delayed but I hope to give them high priority in future.

BIOLOGICAL CONTROL OF INSECT PESTS.

Biological Control was given high priority in the work of the Department during the last few years, particularly in the attempt to save the native cedar *Juniperus bermudiana* L. from extinction. Details of the Department's activities in this respect are fully reported upon by Mr. F. D. Bennett, of the Commonwealth Bureau of Biological Control, who, acting as Plant Pathologist, has been in charge of the work under the direction of Dr. W. R. Thompson.

While a large percentage of the Island's cedars are dead there are hopeful signs that some of the trees still alive may survive further attacks of *Carulaspis visci.* Whatever the real cause may be it is an undisputed fact that some of the trees that survived the initial attacks of *Carulaspis visci* are showing no further signs of deterioration. On the contrary, many trees are producing new growth and assuming a green hue of healthy and unimpeded growth. Another hopeful sign is the vigorous, healthy growth attained by thousands of young cedar seedlings during the year. While these favourable signs may not be truly indicative of the real situation there is a reasonable chance that the turning point has been reached in the fight for survival of the cedar. We should not, however, relax in our efforts to find new and more effective predators and parasites to halt the infestation as completely as possible.

PLANT PATHOLOGY.

The Office of Plant Pathologist became vacant by the resignation of Mr. E. C. G. Bedford on 23rd. July, 1950, and the vacancy thus created was not filled up to the end of the year.

We were fortunate in securing the services of Dr. J. M. Waterston, a former Plant Pathologist in the Department, during his visit to the Colony on vacation leave from his post in Nigeria from 24th July to 24th October. Permission was secured from the Government of Nigeria for the Department to employ Dr. Waterston and he rendered valuable assistance on many laboratory problems and field observations. Dr. Waterston's report is appended following that of Mr. F. D. Bennett.

CITRUS CULTURE.

Citrus Culture which has held the spotlight in the activities of the Department during the past five or six years continued to be of absorbing interest and further satisfactory progress was made in 1950. Planting of new trees continued during the year with undiminished interest; many old growers extended their planting and new growers continued to be attracted by the possibilities of citrus growing in a steady stream.

While it is not possible to estimate the crop of fruit that will be harvested before the season is over it will undoubtedly exceed all previous records.

The conditions of the citrus trees throughout the Island was much improved over the previous years. The damage caused by the two hurricanes of 1948 has now been restored by new growth and barring similar occurrences production records should reach a new high next season. Wind injury is the greatest single hazard to citrus growing in Bermuda and I suspect that many of the symptoms suggestive of nutritional deficiencies may be attributed to check in growth caused by wind injury.

The leadership sparked by Bermuda Citrus Growers Association continued to be an important factor in getting people interested in growing citrus and the co-operation which has existed between the Association and the Department is a fine example of a successful combined operation.

REMOVAL OF DEAD CEDARS AND REAFFORESTATION.

The efforts of the Department to organize two gangs of workmen for the removal work was accomplished early in the year and the target figure to remove 30,000 dead trees was achieved by the middle of December. The two gangs working under the direction of Mr. T. A. Hollis and Mr. Jack King attained a high degree of efficiency in removing dead trees quickly, but there is little inclination on the part of the general public to embark on an ambitious programme of tree clearing.

Tree planting which got off to a good start at the beginning of the year showed signs of slackening as the year advanced, but on the whole the response for greater efforts has been encouraging.

The Department is now equipped to produce plants in great numbers. The Plant Nursery established in Jamaica is supplying us with excellent plant material in increasing quantities and we will shortly reach a point when we can afford to be extravagant in our plant distribution programme.

Detailed information on plant propagation and the reafforestation work generally will be found in the Assistant Director's report.

HEALTH OF ANIMALS.

The report of the Government Veterinary Officer indicates a satisfactory condition with respect to the control of animal diseases. It is particularly significant that the incidence of tuberculosis in cattle is now very low and Brucellosis (Bang's Disease) which attained considerable proportions some years ago has subsided to a great extent.

The rising costs of imported feedstuffs which has since the end of World War II appreciably increased the cost of producing milk is a matter

of great concern to the dairymen and the milk consuming public. Prices of imported feeds in 1950 were approximately 200% higher than those prevailing in 1939, while the price of milk had advanced about 100% during the same period. While dairy farmers do not keep strict accounts of profits and losses the increasing costs of operating weighs heavily on all milk producers, and the least competent of them will face a very serious situation in the near future unless their revenue can be adjusted to meet the increasing costs.

As a result of a report on the sanitary conditions relating to the production of milk by the Government Veterinary Officer, a special committee was appointed by the Board to investigate the matter.

PRODUCTION OF GROUND CROPS AND ANIMAL PRODUCTS AND LIVESTOCK POPULATION.

Below are given statistics of the estimated production of agricultural products:—

A.

Commodity	Area under crop exp. in acres.	Average yield per acres in lbs.	Total yield in lbs.	Unit value	Farm value
Beans	45	4,000	200,000	1/4	£ 13,300
Beets	30	9,000	270,000	5d	5,625
Broccoli	20	2,500	50,000	1/6	3,750
Cabbage	45	12,000	540,000	6d	13,500
Carrots	60	12,000	720,000	6d	18,000
Onions	20	10,000	200,000	8d	6,000
Potatoes (Irish)	275	9,000	2,575,000	5d	53,600
Potatoes (sweet)	15	9,000	135,000	6d	3,125
Tomatoes	60	10,000	600,000	1/-	30,000
Misc.	55	8,000	440,000	6d	11,000
Bananas	80	12,000	960,000	8d	32,000
	705		6,690,000		£ 189,900

B. CITRUS

Area under cultivation in acres	No. of trees	Average yield per tree in dozens	Yield in dozens Total	Unit Value	Farm Value
70	10,000	3	30,000	5/-	£ 7,500

C. LILY BULBS AND FLOWERS.

Area under cultivation in acres	No. of bulbs planted	No. of bulbs exported	Value	No. of flower buds exported	Value
25	1,300,000	230,000	£5,000	1,700,000	£19,700

No. of flower stems exported	Value	Total value of all lily products.
44,000	£11,000	£35,500

D. MILK.

Total production expressed in gallons.	Value
600,000	£150,000

E. MEAT PRODUCTS.

Beef in lbs.	Value	Veal in lbs.	Value	Pork in lbs.	Value	Poultry in lbs.	Value
50,000	£3,125	60,000	£3,750	300,000	£18,750	50,000	£5,000

F. EGGS

Expressed in dozens	Value
3,000	£105,000

LIVESTOCK POPULATION.

A. DAIRY ANIMALS:

Cows	Heifers	Bulls	Total.
1,080	100	20	1,200

B. HORSES:

Farm & Truck	Carriage	Race Horses	Total.
100	80	60	240

C. PIGS:

Sows	Boars	Store Pigs	Piglets	Total.
200	40	1,300	400	1,940

VISITORS

A large number of people visited the Agricultural Station during the year, many of whom expressed interest in the ornamental gardens and trial grounds.

Distinguished visitors included: Dr. A. F. Camp, Vice Director in Charge, Citrus Experiment Station, Lake Alfred, Florida; Dr. Herklot, Secretary, Agricultural Research, Colonial Office; Dr. H. F. Dietz, Pest Control Research Section, E. I. duPont deNemours & Company, Wilmington, Delaware; Dr. W. R. Thompson, Director of the Commonwealth Bureau of Biological Control, Ottawa, Canada; Mr. Wendell F. Sellers, Assistant Director, Commonwealth Bureau of Biological Control, California; Professor J. G. Matthysses, Associate Professor of Entomology at Cornell University, New York.

ACKNOWLEDGEMENT.

Grateful thanks are expressed to individuals and institutions who publications, planting material and help of various kinds. The generous assistance afforded by the Governments of Jamaica and Trinidad mitting their respective Departments of Agriculture to co-operate establishing Plant Nurseries to assist Bermuda's Reafforestation Proramme, has been a great benefit to Bermuda.

It is a great pleasure to record the loyal work of all members of the Department, who during a very strenuous year have cheerfully performed their duties with efficiency and devotion.

Respectfully submitted,

W. R. EVANS,
Director of Agriculture.

21st. March, 1951.

Report of the Assistant Director of Agriculture For the Year 1950.

To: The Director of Agriculture:

I have the honour to submit a report of my work for the year 1950.

AGRICULTURAL STATION.

GENERAL: The work of re-planning the Agricultural Station commenced in 1949 was persued with unrelenting vigor throughout the year under review. Plantings made in 1949 grew very satisfactorily and further plantings undertaken in 1950 are also well established. Fortunately, apart from a drought during the early part of the year, the weather was good and remarkably free from gales. Flowering shrubs produced an abundance of blossom, particularly the autumn flowering species. Due to improved methods of mowing, the lawns were kept in far better condition than was possible in previous years. This factor alone made a vast improvement throughout the entire Station, since areas which were previously regarded as rough pastures are now neatly cut undulating lawns.

The building programme as outlined in January, 1950, was carried out to its successful conclusion. The following projects were completed: Forestry Centre, Exhibition Ring, Press Stand, Two large Slat Houses completely rebuilt, One Glass House renovated, another room added to the Main Office building, the Old Exhibition Stable demolished and a new building commenced on the same site.

Although there is no system in operations at the time of reporting, to record the number of visitors to the Station, it appeared obvious that as the improvements became known many more people visited the establishment both residents and tourists than hitherto. At times during April and May the Main Drive was heavily conjested with motor vehicles while tourists were taking photographs of the flower beds in front of the Offices and in other parts of the grounds. The progress made during the last two years has appealed enormously to the residents of the Colony who have commented very favourably on the work accomplished. Very encouraging remarks were made relative to the progress of converting the Agricultural Station into an attractive ornamental garden by honourable members of the House of Assembly during the consideration of Government Expenditure for 1951.

Despite the progress made during the last two years there is room for further improvement. The work to be done in the future may not appear so conspicuous to the casual observer, but it is extremely important that the new features are properly maintained which is even more exacting and important than the actual work of replanning.

MAJOR PLANTINGS: The major planting schemes consisted of a shrub border from immediately east of the Poultry Building to the Ex-

hibition Ring. This border was largely planted with choice varieties of Hibiscus imported from Florida. The hillside east of the Exhibition Ring was planted with common varieties of Hibiscus interplanted with shade trees such as *Ficus nitida, Albizzia lebbek, Terminalia catappa,* and *Melia azedarach.* A belt of *Casuarina equisetifolia* was planted on the west and north of the Ring. Eleven varieties of Avocado Pears were planted south of the Montrose Orchard. In the area between the Montrose Nursery and the Old Economic Plot a collection of forty-two species of Palms were planted, to form a Palm collection. The Rock Garden was completely remodelled and planted with succulent and cactus plants. In other parts of the grounds wherever cedar trees had been removed plantings of new trees were undertaken. It will be observed from the foregoing that the principle of the planting schemes has been to group the various types of plants together to make it easier for visitors to compare one species or one variety with another.

ORCHID COLLECTION: Thanks to the painstaking efforts of the Horticulturist, the collection of Orchids has been built up into one of the largest and finest in the Colony. Many new Cattleyas and Laelio-Cattleyas were introduced, all of which are making excellent growth and freely flowered. The Orchid House is now a centre of attraction, especially to tourists. With the larger number of species and varieties the flowering period is spread over a much longer period. The bulk of the Cattleyas bloom from December to March, but with the other genera represented in the collection it is now possible to find a plant or plants in bloom during every month of the year.

CITRUS ORCHARDS: On the whole the Citrus Orchards were well maintained. A late attack of rust mite seriously discoloured many of the fruits of both orange and lemon. Due to increasing the sulphur sprays and decreasing the application of oil emulsion, there was a build up of the soft brown scale towards the end of the year. However, two applications of oil emulsion during the latter part of December cleaned the trees. In late November the trees were sprayed with an insecticidal and nutritional spray obtained from Florida. This material, extensively used by the Floridian growers contains the trace elements and sulphur as an insecticide and fungicide in the following proportion: 51% sulphur; 5% copper; 6% zinc sulphate; 4% maganese oxide and 34% inert ingredients. The Victory Orchard produced an average crop of fruit. Oranges were light except the variety Hamlin which carried a very heavy crop. Tangeloes also cropped heavily, the flavour and juice content of which were excellent. In the Old Orchard very little fruit was obtained.

EASTER LILY VARIETIES: The collection of varieties of the Easter Lily *Lilium longiflorum var. eximium* is gradually being enlarged. Several very good types have been selected from the stock presented to the Department of Agriculture by Mr. Howard E. Smith, O.B.E. Further selections of these varieties will be made during the coming season, with the object of increasing the stock of the more promising types. The plants were carefully rouged during the growing season to eliminate the yellow flat and mosaic diseases. Plants of the variety Howardii commenced blooming at the end of January. These were followed by the other varieties which gave a continuous supply of blossom until the end of May. The plot was a very popular rendezvous for tourists, who took numerous photographs of the pure white flowers.

GLADIOLUS VARIETIES: A special feature of Gladioli was planned for the Easter Season. Six varieties, namely, Odin, Picardy, New Europe, Gold Dust, Crimson Glow and Albino were planted in the border east of the northern experimental plots. These varieties produced a most spectacular display.

OFFICE FLOWER BEDS: Petunias, Antirrhinums, Larkspur, Phlox and Pansies formed the main display in the Office flower beds. The Petunias were especially fine. Annual Chrysanthemums edged with Phlox also made a particularly pleasing colour scheme.

LABELLING: The work of labelling all the plants now in cultivation at the Agricultural Station is a formidable task. This entails a considerable amount of research into botanical literature to check the species and to keep as far as possible to modern nomenclature. A start was made in this work during 1950. In the first instance it was considered desirable to make a card index of all the plants established, and from this index to write the labels. A new type of label has been introduced made of a light metal which appears to stand up to the Bermudian climatic conditions remarkably well.

The absence of labels from the ornamental plants is one of the worst features of the Agricultural Station. The visitors cannot fully appreciate the plants unless they have a label attached giving the common and botanical names with the habitat. Information of this kind is naturally expected. Every effort will be made during 1951 to have this work satisfactorily completed.

APPROPRIATE SIGNS: Another innovation to the Station during the past twelve months is the new sign boards made of cedar wood which now dominate the grounds. The signboard at the Main Entrance denotes a change in the future name of the establishment. It reads "Department of Agriculture Ornamental Gardens and Trial Grounds".

RAINFALL: The following monthly rainfall was recorded at the Agricultural Station during 1950:

January	0.36 inches
February	2.35 "
March	4.50 "
April	2.89 "
May	6.41 "
June	3.34 "
July	5.27 "
August	3.70 "
September	8.60 "
October	7.79 "
November	4.24 "
December	2.96 "
	52.41 "

FIELD EXPERIMENTS.

FIVE YEAR MANURIAL & COSTINGS EXPERIMENT: A detailed report on the first season's cropping of the five year manurial and costings experiment was submitted in July. While the results were not outstanding, obviously, the prolonged dry period must have been largely responsible for the low yield of the potato crop. For instance the rainfall recorded at the Agricultural Station during the period of operations, namely, from July, 1949 to June, 1950, amounted to only 38.26 inches which was 16.74 inches below the average annual rainfall. During the months of December, January and February in the centre of the cropping season only 4.51 inches of rain was recorded. With the exception of Cabbage all the crops gave a higher yield per rod in the plot treated with 4:12:6: a chemical fertilizer. In the case of Cabbage the highest yield per rod came from the plot treated with farmyard manure. On the other hand, as Table I will show, the yield of Ruta Baga was considerably lower from the same plot.

TABLE I.

Plot	Rate of Fertilizer Applied	Yield per Rod			
		Potatoes Triumph	Cabbage	Carrot	Ruta Baga
WEST	12 cwts. per acre 4:12:6	23 lbs.	141 lbs.	127½ lbs.	137 lbs.
CENTRE	16 tons per acre F.Y.M.	17 lbs.	150 lbs.	111 lbs.	98 lbs.
EAST	12 cwts. per acre Castor pomace.	18 lbs.	129 lbs.	79½ lbs.	133½ lbs.

In dealing with the costings side of the experiment it will be observed from Table II that the value of the farmyard manure is considerably higher than the artificial fertilizers. This, however, is a farm value only and does not represent a cash transaction. A farmer who keeps animals, either pigs or cattle, would have this manure at his disposal, whereas, in the case of the artificial fertilizer this would be a direct cash transaction. Nevertheless, if a complete costings account was kept by the farmer it would be found that the value of the animal manure including haulage would work out at approximately treble the cost of fertilizers from the bag.

The main purpose of this experiment is to determine what effect the continual application of the artificial fertilizers without farmyard manure will have on the soil. It is a wellknown fact that humus is very quickly decomposed in the Bermuda soils and by continually withholding farmyard manure, the soil fertility may be quickly impaired. As the experiment continues this factor may become very outstanding in the analysis of the results.

Tables II and III show the expenses incurred during the cropping season and the market value of the crops harvested.

TABLE II.

Expenses during Cropping Period.

Plot	Seed & Plants	Fertilizer	Cultivator	Labour	Spraying	Total
WEST	£7 19 0	£3 18 9	£3 5 9	£49 19 5	£4 7 3	£69 7 3
CENTRE	7 16 0	20 0 0	3 9 7	49 0 3	4 7 3	84 13 1
EAST	6 13 9	2 14 3	2 3 4	39 4 2	4 7 3	55 2 9

TABLE III.

Market Value of Crops Harvested.

Plot	Potatoes	Cabbage	Carrots	Ruta Baga	Total
WEST	£18 7 2	£27 0 0	£20 0 0	£26 0 0	£91 7 2
CENTRE	12 0 7	29 7 6	18 0 0	19 0 0	78 8 1
EAST	10 6 3	18 10 0	9 0 0	18 15 0	56 11 3

Area of Plots:	West	47 sq. rods.
	Centre	47 " "
	East	34 " "

BANANA EXPERIMENT: It was decided during the year that an experiment should be conducted over a period of five years on the cultural requirements of the Banana. The Banana is now one of the major crops for local consumption. There are many problems effecting the culture which have never been satisfactorily explained. No special efforts within recent years have been made to study the requirements of the Banana, so provision has been made to conduct the experiment using the two northern plots at the Agricultural Station for this purpose.

To facilitate the planting at different times of the year, the two plots were divided into 3 sections. The first section was planted in August, 1950, the second in December, 1950 and the third section will be planted in March, 1951. Different types of fertilizers will be used in the experiment and the effect of seaweed as a fertilizer will be studied; and compared with other types.

THE CONTROL OF WEEDS BY WEEDKILLERS: A series of tests were made during the summer by the Acting Plant Pathologist and the writer of this report on the control of weeds in lawns and on pathways by the application of the 2:4:D: selective weedkillers. Some interesting results were obtained but before details of the tests are released further trials on a larger scale will be undertaken.

PLANT PROPAGATION.

LOCAL PLANT NURSERIES: The plant nurseries were completely reorganized to increase efficiency and output. It was found desirable to divide the nurseries into four main divisions.

1. *Propagating Centre:* The glasshouses were allocated for all propagation work. Two new cutting beds were installed in the western house.

2. *Nursery Centre:* The two large slat houses south of the Forestry Centre are now used as growing houses. As the seedlings and rooted cuttings are planted in tins they are removed from the propagating centre to this section.

3. *Forestry Centre:* When the plants become large enough for sale they are transferred to the Forestry Centre which is essentially the sales room. This system has saved a great deal of time and inconvenience to those attending to customers, since all the plants for sale are under one roof.

4. *Open Nursery:* In addition to the above it was necessary to enlarge the open nursery to increase the output of plants which can be successfully transplanted with bare roots. For this work an acre of good arable land was made available to the Department on the "Norwood" Estate by the kindness of Mr. & Mrs. F. Aeschliman. General Glancy of "Willow Bank", Somerset, also made available a part of his garden which was used by the Department for the same work. A small area of land north of Montrose Cottage at the Agricultural Station was also broken up and planted with cuttings. These open nurseries have been invaluable. By this method it was possible to substantially increase the propagation of various plants without drawing too heavily on the limited water supply at the Agricultural Station.

It is estimated that the stock of plants now held by the Department in the nurseries exceeds 50,000 specimens. With the present system in operation it would be possible to further expand the production of plants if the demand is keen enough to justify such action. The water supply was very precarious during the first half of the year when most of the tanks were empty. However, the position rapidly changed in the second half of the year and by December several of the water storage tanks were overflowing.

CITRUS NURSERY: An attempt has been made to propagate citrus in Bermuda. One thousand seedlings of the rough lemon were raised and transplanted into nursery rows. When these seedlings are large enough they will be budded with varieties of grapefruit, orange, tangelo and lemon.

OVERSEAS NURSERIES: To augment the local propagation of plants it was found desirable to establish plant nurseries in both Jamaica and Trinidad. The Jamaica nursery was started in July and Trinidad in October. These nurseries are operated by the Department of Agriculture of the respective Colonies, from funds provided by the Government of Bermuda.

Good progress has been made in Jamaica. Up to the 31st December, 1950, the following plants were received from this source:

2,150	trees
1,450	climbers
400	shrubs
4,000	Total.

The plants were forwarded with bare roots by air. On arrival they were either planted in tins and held in the nursery at the Agricultural Station until well established or sold immediately as young plants if the demand was sufficiently keen.

As the Trinidad nursery was not started until late in the year the Department of Agriculture of that Colony very kindly made available 2,670 trees, shrubs and palms from their own stock of plants. These plants were shipped in bamboo containers and kept in quarantine at the Agricultural Station to insure that they were entirely free from pests and diseases.

In addition to the importation of plants from the West Indies some 5,582 trees and shrubs were imported from Florida and Belgium. The total number of ornamental plants imported during 1950 from all sources was 14,252.

SALE & DISTRIBUTION OF ORNAMENTAL PLANTS: Including the trees, shrubs, climbers and palms used in the various planting schemes undertaken by the Department of Agriculture, plants donated to the Arbor Societies and other public bodies and those sold to private individuals the total number of plants sent out from the nurseries during 1950 amounted to 21,730. This represented an increase of 9,922 compared with the previous year.

SALE OF FRUIT TREES: During the year, 1,202 Citrus trees were imported from Florida and sold to the general public at prices below cost. Seven hundred and fifty Avocado Pear trees were obtained from Florida and Trinidad, but as these did not arrive until late in the year, they are being held at the Agricultural Station until March, 1951.

PLANTING AND LANDSCAPING.

A planting unit under the Reafforestation scheme comprised a foreman and four men who were fully employed in planting areas where the dead cedars had been removed. The work of replanting eight private estates was undertaken together with three major projects for the Sandys, Pembroke and St. George's Arbor Societies. In addition to this, planting was done on six Government properties including Admiralty House.

In most cases a system of basic planting was adopted using hardy quick growing trees, shrubs and palms. The object being to create a windbreak and to screen the property to obtain the same privacy to the house and garden which prevailed before the death of the cedars. At the same time preserving the pleasing views which had been opened up. This work entailed a considerable amount of personal supervision in order to obtain the desired effect. The planting sites were carefully prepared by digging large holes and filling these with soil. A compressor was purchased at the beginning of the year which proved invaluable in breaking up the hard rock.

ARBOR SOCIETIES: The Arbor Societies were active in most parishes and some good work was accomplished. Every possible assistance was given these Societies by the Department of Agriculture. A policy was adopted whereby the Department matched the man hours worked by

each Society up to a maximum of 98 man hours per month. Three Societies, namely, Sandys, Pembroke and St. George's qualified to take advantage of this scheme, which resulted in the Department undertaking the following work:

Sandys: In a roadside planting scheme from the Somerset Bridge to the Eastern Boundary of the parish the Department planted 177 trees and shrubs and 300 oleander and Hibiscus cuttings.

Pembroke: The Department provided labour, transportation and plants for three major schemes in the Parish. An avenue of *Casuarina equisetifolia* was planted in Bernard Park and extensive groups of Coconuts and Oleander in the same area. Unfortunately, the Casuarinas in the Park had to be replaced three times owing to acts of vandalism.

St. George's: The main project in St. George's was the planting of Tiger Bay. The Society provided labour to clean and level the area, while the Department provided the plants and did the actual planting.

Another project in St. George's which was planned and supervised by the writer, in co-operation with the St. George's Corporation, was the section of the old Railway right-of-way, immediately west of Tiger Bay. This planting was done early in the year and remarkably good progress has been made by the plants used.

CEDAR PLANTATION: A plantation of *Juniperus bermudiana* was planted on Government land adjoining the Public Works Department Quarry, Harrington Sound. In this area which had been cleared of dead cedars, 800 seedlings were planted. No special preparation of the planting sites was undertaken but a seedling was inserted wherever there was a sufficient depth of soil to make a hole large enough to receive a plant. The planting was done during September and at the time of reporting all the plants appear to be well established.

While the Department does not advise private individuals to plant the Bermuda cedar at this juncture, it was considered advantageous to start replanting the cedar on Government land for two main reasons. Firstly, plantations of young cedars on Government lands can be under strict observation and if necessary destroyed if conditions justify such action. Secondly, if the trees grow satisfactorily and the Juniper scale, *Carulaspis visci* is ultimately controlled, the *Juniperus bermudiana* will have been preserved for future generations, and this valuable and historic species will not have been lost, due to lack of foresight.

It is worthy of record that seed of the Bermuda cedar has been sent to both Dominica and Trinidad where it is hoped the species will become established.

PLANT INTRODUCTIONS.

The policy of introducing new plants of both economic and ornamental value is always under careful consideration. During 1950 seeds and plants of new species have been introduced from many places. Among those of special interest are: *Ficus nitida var., Warringiana; Castanea sativa; Abelia schummanii; Cleyera japonica; Eurya japonica; Ilex east-*

palatha; Ilex Howard; Severinia buxifolia; Viburnun rhytidophyllum; a collection of Cattleya hybrids, a collection of named Hibiscus varieties and a collection of named Chrysanthemums.

SUPERVISION OF OTHER GOVERNMENT PROPERTIES.

Other Government properties which come under the supervision of the Department of Agriculture are: Government House Gardens, Bernard Park, The House of Assembly Grounds, the Colonial Secretariat Grounds and the Small Park at Crow Lane, Paget.

The Department undertook the responsibility of the maintenance of the House of Assembly Grounds and the Colonial Secretariat Grounds during 1950. Several major improvements have been made in both places. It is hoped that the appearance of these important Government Centres will be vastly improved in the future. A collection of 400 Easter Lily Bulbs were planted around the Cenotaph donated by Mr. Abel Benevides, a member of the Board of Agriculture.

INSPECTION OF EASTER LILY PLANTINGS.

The first inspection of the lily fields took place between January 17th and 31st and the second was carried out between 20th March and 2nd April. Out of a total of 44 fields inspected, 42 passed the final inspection, giving an area of 26.4 acres. The two fields condemned were due to the growers failing to rouge the plants when requested to do so.

OTHER ACTIVITIES.

Advisory Visits: Throughout the year I made 240 advisory visits. The nature of the enquiries covered a variety of subjects including citrus culture and landscape gardening, which necessitated travelling to all parts of the Islands.

Broadcasts: The following Departmental radio broadcasts over Z.B.M. were undertaken:

12 April:	"Tour of the Agricultural Station" with members of the Office Staff.
14 June:	"Beekeeping" with members of the Bermuda Beekeepers Association.
12 July:	"The Oleander" with the Director of Agriculture and the Horticulturist.
8 Nov:	"Current Enquiries" with the Agricultural Assistant and Acting Assistant Horticulturist.
13 Dec:	"Citrus Culture" with members of the Citrus Growers Association.

A talk was given to the Lion's Club on 6th September on "Plant Quarantine Regulations".

Exhibitions: Three exhibitions were held during the year, namely: The Sandys Flower Show at which a Departmental Exhibit was staged on the 4th May. The Poultry Exhibition on the 1st, 2nd and 3rd November and the Citrus Exhibition held on the 14th, 15th and 16th December, both of which were held at the Agricultural Station.

Publications: The writer wrote a bulletin on "Trees, Shrubs, Palms and Succulent Plants" which was published by the Department of Agriculture in June, 1950.

Colour Transparencies: A collection of over 100 colour transparencies were taken during the year of views of the Agricultural Station and of good garden plants.

Personal: I acted as Director of Agriculture from the 8th to 24th June and from 2nd November to 8th December, inclusive.

Respectfully submitted,

GORDON R. GROVES
Asst. Director of Agriculture.

January 27th, 1951.

Report of the Acting Plant Pathologist For the Year 1950.

To: The Director of Agriculture:

I have the honour to submit a report on work done on plant diseases and pests during the year 1950.

GENERAL REVIEW

Mr. E. C. G. Bedford, Plant Pathologist since 10th May, 1948, resigned in April 1950. Mr. Harry Payne, Entomologist, from the Commonwealth Bureau of Biological Control, Fontana Laboratory, California, acted as Plant Pathologist until June 1st. The writer commenced duties on June 2nd, 1950.

Dr. J. M. Waterston, a previous Plant Pathologist of Bermuda investigated certain entomological and pathological problems during a visit to Bermuda from 24th July to 24th October. A report of his observations is given.

The difficult task of attaining biological control of the Juniper scale *Carulaspis visci* (Shrank) an introduced pest of the Bermuda's endemic "cedar tree" *Juniperus bermudiana* L. was the main problem investigated and occupied most of the time of the previous pathologists and the writer. Introductions of the dipterous parasite *Cryptochaetum icerya* for the control of Cottony Cushion Scale *Icerya purchasi* were also made.

BIOLOGICAL CONTROL OF INSECT PESTS

A. CARULASPIS VISCI ON CEDARS.

1. *Carulaspis visci and the condition of the Cedar Trees:*

The rate of defoliation and actual dying of cedar trees during January and February, 1950, was very rapid. The cause of the rapid deterioration was due, partly to the accumulative after effects of a medium infestation of *Carulaspis visci* during the latter part of 1949 and partly due to the prolonged drought during the winter months. Since the commencement of the programme to introduce biological control of the juniper scale the climatic conditions have been very unfavourable. In 1948 damage by salt spray blown onto the foliage by the hurricane of September 13th. was sufficient to defoliate and greatly weaken thousands of trees. The majority of the weakened trees put out a flush of new growth during the spring of 1949. The effects of a light infestation of scale during the summer of 1949 coupled with the dryest autumn and winter in more than ten years caused an accelerated rate of decline among the weakened trees. The lack of normal rainfall continued throughout January and February and the prospect of saving any of the rapidly dying cedars looked very gloomy.

More favourable weather conditions have prevailed since March 1st. Rainfall has been average and quite uniformly distributed throughout the summer and autumn months. A new flush of growth was put forth during the spring and summer months. This foliage despite a light or medium infestation of *Carulaspis visci* in the majority of cases has remained alive. However, the healthier stands of trees in Sandys and Southampton parishes have continued to deteriorate slowly despite all efforts to control the scale by concentration of predators in these areas. It seems probable that unless some new development takes place the fairly healthy stands of trees which remain in the western parishes of Bermuda will eventually assume the general appearance of the trees in the remainder of the parishes.

Scattered throughout the central and eastern parts of the Islands there are a few examples of cedar trees which appear to be much less affected by the scale than do the majority of the trees. Although these trees have been exposed to the same infestation of scale as the neighbouring trees they have not lost their foliage. There exists the slight possibility that there is a scale tolerant strain of the Bermuda cedar.

2. *Lindorus lophanthae* Blaisd.

The coccinelid *Lindorus lophanthae* was introduced in 1947. It became established very quickly and rapidly spread throughout the Islands. *Lindorus* adults and larvae could be found in practically every area by December, 1948 and it appeared evident that if the same rate of increase continued throughout 1949 the scale infestation would be controlled. By December 1949 it seemed certain that *Lindorus* was capable of providing partial control only and additional controlling factors were necessary.

General surveys to determine the distribution of *Lindorus* were made in December 1949 and December 1950. In 1949 a total of 108 cedar trees taken at random from 27 stands of trees located at intervals along the main roads from Somerset to St. George's were examined for *Lindorus*. Trees were inspected by beating one branch over a white sheet and then counting the larvae and adults present on the sheet. Twenty-six of the same stands of trees were examined in the same manner in December 1950, and the following comparisons were made.

	1949	1950
Sites compared	26	26
Total branches beaten	104	104
Total *Lindorus* adults	81	96
Total *Lindorus* larvae	442	293
Sites where *Lindorus* was absent	9	14

It is evident from the above figures that Lindorus has had time to reach its maximum capacity in the field and apparently does not offer a sufficient degree of control to permit the survival of the trees. *Lindorus* was absent in several areas in 1950 where it was present the preceding year. In some areas where *Lindorus* was present in 1949 but absent in 1950 the trees had declined to the extent that sufficient foliage was not present to support an adequate infestation of scale necessary to maintain

Lindorus. *Lindorus* was absent in a few areas where medium infestations of scale were found. A possible explanation appears below.

3. *Ants on Cedar Trees:*

The common ant in Bermuda *Pheidole megacephala* F. has long been suspected of carrying off predators from cedar trees. In October experiments were started to determine the effect of controlling ants on the trees. An area at Warwick Long Bay was chosen as ants were very numerous on the trees and no recoveries of *Lindorus* had been made since June 1st. 1950. D.D.T. dust (50%) was spread around the base of the tree and two days later observations showed that there were no ants present on the tree. Adults of three species of predators — *Lindorus lophanthae, Telsimia sp.* and *Cybocephalus sp.* — were liberated on this tree and on two neighbouring trees.

Four recovery trips were made since this liberation. On the first occasion, two weeks after the liberation, adults of all species and numerous larvae of *Lindorus* were found on the ant free tree whereas only two small *Lindorus* larvae were recovered from the ant-ridden trees on which beetles had been liberated. Adults and larvae of *Lindorus* and adults of *Telsimia* have been recovered on each visit to the ant free tree but no further recoveries have been made on neighbouring trees.

In December 1950, ants were observed carrying *Lindorus* larvae down the trunks of cedar trees. On one occasion five larvae were carried down the trunk of one tree in a period of less than five minutes.

The presence of ants is possibly a very important factor in the lack of control of *Carulaspis* and the possibility exists that *Lindorus* would control the infestation if ants were barred from the cedar trees.

4. *Introduction and Testing of New Predators of Carulaspis visci:*

(a) *Portugal:* Six shipments containing four species of predators of *Carulaspis visci* were received from Dr. Suter, Portugal. The four species — *Exochomus quadripustulatus, Chilocorus bipustulatus, Scymnus sp.* and *Cybocephalus rufifrons* were tested on *Carulaspis* infested foliage in the laboratory and were confined in cloth bags on branches of cedar trees in the field. Larvae of all species were produced in the laboratory and larvae of *Chilocorus, Exochomus* and *Cybocephalus* were recovered from branches on which adults had been confined a few weeks earlier.

(b) *Florida:* A shipment containing 119 adults of *Chilocorus bivulnerus* was received from Florida in February. Although this species produced larvae when confined on scale infested foliage in the laboratory no recoveries were made when adults were confined in bags on cedar trees.

(c) *England:* One shipment containing several pupae and six larvae of the Neuropteran *Semidalis aleyrodiformis* Steph. Family Coniopterygidae was sent by Mr. E. C. G. Bedford from England where it was found feeding on *Carulaspis visci.* Adults were confined on cedar foliage in the laboratory and in the field. Numerous larvae were produced in the laboratory but all of them died before reaching the pupal stage. No larvae were recovered from the field tests.

5. *Predators from California:*

During 1950 a total of 487 shipment boxes which contained 355,716 beetles were received from Wendell F. Sellers, Assistant Director, Commonwealth Bureau of Biological Control. The predators were reared at the Fontana Laboratory, Fontana, California. The beetles were shipped by airmail and arrived in excellent condition three or four days after shipment.

The predators were utilized as follows:

Liberated on cedar trees	353,433
Retained in the Bermuda Laboratory for mass rearing	2,283
Total:	355,716

The species of predators received from California were as follows:

Telsimia sp.; Cybocephalus sp.; (origin China); *Cybocephalus sp.* (origin S. Africa); *Zagloba ornata; Lotis nigerrima; Cephaloscymnus occidentalis; Microweisia suturalis; Lindorus lophanthae; Pharoscymnus exiguus;* and *Lotis neglecta.*

Large scale liberations of all species except *Pharoscymnus, Lotis neglecta* and *Cybocephalus sp.* (origin S. Africa) were made in 1950. Small liberations of *Lotis neglecta* were made in 1949. Limited liberations of *Pharoscymnus* were made in 1949 and 1950. No liberations of *Cybocephalus sp.* (origin S. Africa) have been made.

Several of the shipments of beetles from California were contaminated with the predacious mite *Hemisarcoptes malus,* a scale predator and it can therefore be recorded that several thousands of this predator were liberated.

6. *Predators reared in Bermuda:*

During 1950, 968,787 predators for liberation were massreared in the laboratory at the Agricultural Station. Potato tubers infested with the Bermuda Oleander Scale or West Indian Peach Scale *Aulacaspis pentagona* Targ. were used as the host.

7. *Liberation of Predators Against Carulaspis visci:*

The monthly liberation of the various predators against *Carulaspis visci* is given in Table I. The total number of beetles liberated in 1950 was 1,322,220. Two hundred and fifty-two trips by car were made to liberate these beetles. Liberations were confined mainly to the areas of good trees in Southampton and Sandys parishes.

8. *Recovery of Predators:*

(a) *Microweisia:* Promising recoveries of *Microweisia suturalis* have been made during 1950. Adults and larvae were recovered at four sites where the last liberation of beetles was made at least five months earlier.

The most notable recoveries were made in the Frying Pan Area, Sandys Parish. Adults and larvae were found on several occasions on trees in an area where no beetles had been liberated since June 1949. In August, 1950, branches of four trees were beaten over a white sheet and 58 adults, 163 larvae and four pupae were counted. One branch yielded 46 adults, 110 larvae and 3 pupae. Although fewer beetles were recovered in other areas it is possible that this predator will eventually build up to the point where it exercises some degree of control over *Carulaspis.*

Microweisia suturalis Schwartz: was introduced from California where it is a predator on *Carulaspis visci* on Monterey Cypress.

(b) *Telsimia:* Numerous recoveries of adults and larvae of *Telsimia* were made. Adults and larvae were recovered in most areas, where *Telsimia* was liberated, for a period of one to two months, but after one or two generations no recoveries could be made in the majority of cases. In a few instances small numbers were recovered in areas where the last liberation was made six months previously. At this time it appears doubtful that *Telsimia* will play an important part in the control of the Cedar Scale.

(c) *Recovery of Other Beetles:* Limited recoveries of *Cybocephalus sp.* (origin China); *Lotis nigerrima; Zagloba ornata;* and *Cephaloscymnus* were made but, as yet, none of them have increased sufficiently to be of biological importance.

(d) *Hemisarcoptes malus:* The predacious mite *Hemisarcoptes malus* was originally introduced to control the Oyster-shell scale *Lepidosaphes newsteadi* Sulc. on the juniper. In February, 1950, Mr. E. C. G. Bedford observed specimens of the mite feeding on the eggs of *Carulaspis visci.* Subsequent observations have shown that *Hemisarcoptes* is fairly well established as recoveries have been made in Sandys, Southampton and Warwick parishes.

Investigations in December showed that *Hemisarcoptes* was quite numerous in the Warwick Long Bay area. Adults of the Coccinelid *Lotis nigerrima* reared on stocks of mite-contaminated scale were received from the Fontana Laboratory, California and liberated in this area during the summer months of 1950.

9. *Parasites of Carulaspis visci:*

Cedar foliage from three sites was placed in parasite emergence boxes in September and the emerging parasites were collected and counted. The chalcid *Aspidiotiphagus lounsburyi* Berl. which was most numerous in previous collections, was quite scarce in collections from two of the sites, but numerous from the third site. The predominant parasite from two of the sites was *Thysanus louisianae. Prospaltella fasciata* was also represented from all sites.

10. *Chemical applications to Cedar Trees:*

During the early months of the year limited tests were made with "Nu Green" (a nutrition spray containing nitrogen). Applications were made to the foliage but none of the trees showed any response.

B. *CRYPTOCHAETUM ICERYA* WILL. — *A DIPTEROUS PARASITE OF ICERYA PURCHASI* MASK.

1. *Introduction:*

The Cottony Cushion Scale *Icerya purchasi* has been present in Bermuda for several decades. In 1902 the Vedelia lady-bird beetle *Rodolia cardinalis* was successfully established by G. A. Bishop. This beetle has given fairly good control of the cottony cushion scale. However, during the winter months *Rodolia cardinalis* is inactive and temporary infestations of cottony cushion scale build up. These infestations seldom kill healthy citrus trees but *Pittosporum* and *Acalypha* plants are frequently killed. Furthermore, since the loss of the majority of Bermuda's cedars thousands of Casuarina seedlings have been planted. This tree is not susceptible to attack by the cottony cushion scale after it attains a growth of six or eight feet, but it can be badly stunted by a medium infestation of cottony cushion scale during the first two years of growth.

Therefore, despite the fact that *Rodolia cardinalis* exercises fairly good control over *Icerya purchasi* it was decided that the introduction of a parasite would be beneficial.

Cryptochaetum icerya Family Agromyzidae is an important parasite of the cottony cushion scale in the coastal regions of California, where the humidity is high and conditions are somewhat similar to Bermuda.

2. *Introduction of Cryptochaetum:*

During 1950, three shipments of *Cryptochaetum icerya* were received from W. F. Sellers, Commonwealth Bureau of Biological Control, Fontana, California. Shipments containing cottony cushion scale parasitized by *Cryptochaetum* were received in May, July and September. The material was handled under strict quarantine. The adult parasites were removed daily, held in quarantine twenty-four hours and liberated. Liberations were made in Warwick, Pembroke, Paget, Smith's and Hamilton parishes in locations where infestations of cottony cushion scale were present. Parasites were liberated on scale infested citrus trees, pittosporum and Casuarina seedlings. A total of 3,126 adults were liberated.

Recovery of Cryptochaetum from points of Liberation:

Return trips were made to all sites in an attempt to recover the parasites. Recoveries were made at five of the nine liberation points. Parasitized scales have been observed every month from July to December inclusive and several adult parasites have emerged from scales which were brought back to the laboratory. It appears that *Cryptochaetum* is established in Bermuda and should successfully supplement the work of *Rodolia*.

INSPECTION SERVICES.

Japanese Beetle Quarantine:

As in past years steps were taken to prevent the establishment of the Japanese Beetle *Popillia japonica* Newm. in Bermuda. Japanese Beetle traps were set out at three points in the first week in June and

removed after the end of September. No Japanese Beetles were captured in these traps.

Several consignments of cut flowers were inspected during the June —September period when Japanese Beetle quarantine was in force.

No live or dead beetles were found on the steamship "Queen of Bermuda". A total of seven Japanese Beetles, three live and four dead, were intercepted on U. S. Airforce Planes landing at Kindley Airfield.

No Beetles were intercepted at the American Naval Operating Base.

INSPECTION OF PLANT IMPORTATIONS AND INTERCEPTIONS.

* Denotes a new record.

During the year over 200 parcels and shipments of imported ornamental shrubs and flowers, fruit trees, etc. were inspected by members of the Department.

Several shipments of imported Christmas trees were examined. A Diaspine scale probably *Phenocaspis pinifoliae* was intercepted on a consignment of Christmas trees from New Brunswick, Canada.

A large consignment of Gladiolus corms infected by **Sclerotinia gladioli* (identified by Dr. J. M. Waterston) imported from the U.S.A. was destroyed.

One barrel of Yams and Coconuts from the West Indies, infested by a species of black ant was fumigated and passed.

The following consignments imported contrary to the Bermuda Bye-Laws were intercepted and destroyed: Bananas (6); Plants in soil (5); Sweet Potatoes (4); Corn Cobs (2).

Four adults of a large beetle (Family Passalidae) were intercepted in a shipment of *Cryptostegia grandiflora* R. Br. from Trinidad. The beetles were discovered among the roots of the plants which were potted in bamboo canes.

INSECTS, MITES AND PLANT DISEASES RECORDED.

Arranged according to Hosts — * Denotes a new record.

Allium cepa L. Onion.

Severe damage to onions by the onion thrips *Thrips tabaci* Lind. was noted at the Agricultural Station during February.

Brassica oleracea L. Cabbage, Cauliflower & Mustard.

Murgantia histrionica Hahn. The Harlequin bug was very numerous and caused injury to the crops mentioned. Complaints from farmers and gardeners were received almost every month of the year.

Casuarina equisetifolia L.

* Powdery Mildew, *Oidium* sp., was recorded by Dr. J. M. Waterston.

Cottony cushion scale *Icerya purchasi.* Mask. caused the stunting of growth of several young trees at the Agricultural Station.

Citrus spp.

Tender shoots of several varieties of citrus were attacked by two species of aphids. Although *Aphis gossypii* Glov. was most numerous in the autumn months **Toxoptera aurantii* Fonsc. was quite prevelant in July and August (Det. U.S.D.A.).

Both species were attacked by the larvae of the Coccinelid *Scymnus terminatus* and by two Hymenopterous parasites *Aphidius testaceipes* Cress. and **Pachyneuron siphonophorae* Ashm. (Det. U.S.D.A.).

Discolouration of fruit due to the feeding injury of the rust mite *Eriophyes oleivorus* Ashm. was common in orchards where the necessary sulphur sprays for control were not applied.

Cottony cushion scale *Icerya purchasi* Mask. was prevalent in a few orchards in the early spring months but was brought under control by the Coccinelid *Rodolia cardinalis* Muls.

Boron deficiency in grapefruit was recorded by Dr. J. M. Waterston.

The white fly *Dialeurodes citrifoldii* Morg. was common. Larvae and adults of the Coccinelid **Clitostethus arcuatus* Ross. were observed feeding on it. (Det. Com. Inst. Ent.).

Ficus carica L. Fig.

The fungus *Sphavostilbe repens* was recorded on fruit by Dr. J. M. Waterston.

Ficus nitida Indian Laurel.

The thrips **Gnaikothrips ficorum* Marcha. was first observed in January, 1950, on a Ficus plant imported from Florida during the previous month and the thrips may have been introduced with it.

Curling and browning of leaves due to Thrips was noted in November at "Windy Hill", Pembroke. Investigation showed that the plants had been imported in the same shipment as the plant on which the thrips was first discovered. (Det. Com. Inst. Ent.).

Juniperus bermudiana Bermuda Cedar.

The spruce mite *Paratetranychus ununguis* Jac. was recorded as quite numerous on young trees during January.

The Oyster-shell scale *Lepidosaphes newsteadi* Sulc. was seen only in one location. Examination of material showed that many of the scales

had been parasitized by the Chytrid fungus *Myiophagus ucrainica* (Wize) Sparrow.

The mite *Hemisarcoptes malus* was recorded as a predator on *Carulaspis visci.* This is a new host record for Bermuda.

Mesembryanthemum serrulatum:

Several plants at the Agricultural Station were killed by Leaf Rot caused by the fungus **Phytophthora parasitica.* Det. by Dr. J. M. Waterston.

Musa Cavendishii Lamb. Banana.

Feeding by thrips causing severe silvering and browning of the skin of the banana fruit was noted on two occasions. The injured bananas failed to mature properly — the outer portions turning soft before the central core of the banana ripened. Four species of thrips were collected from the injured bananas. The commonest species was *Hercinothrips femoralis* Reut. The other species were *Hercinothrips bicinctus; Hercinothrips sp.* and *Franlinothrips sp.* The last species is recorded as a predacious thrips. (Det. Com. Inst. Ent.).

Three species of moths were bred from the floral tips of bananas during the investigation of the Black Tip Disease of Bananas (see report by Dr. J. M. Waterston). One species **Ereunetis minuscula* Walsm. Family Lyonetidae was most numerous. A few adults of **Cryptoblabes gnidiella* Mill. Fam. Pyralidae and of **Pyroderces rileyi* Walsm. Family Cosmopterygidae were also present. An additional Pyralid **Fundella sp ? (pellucens)* Zell. was bred from banana tips in 1949.

Nerium Oleander L. Oleander.

Several outbreaks of the Oleander Scale *Aulacaspis pentagona* Targ. occurred during the year. Investigation showed that the percentage of parasitism by *Aphytis diaspidis* was very low. The Tarsonemid mite *Pediculoides ventricosus* Newp. which is predacious on the pupal stage of parasitic Hymenoptera was present at all sites where the oleander scale was examined. The Aphelinid parasite *Aspidiotiphagus lounsburyi* was more numerous than *Aphytis diaspidis* the common oleander scale parasite. The fact that Aphytis is an external parasite whereas *Aspidiotiphagus* is an internal parasite may be the reason why only *Aphytis* was attacked by the mite.

Larvae of the Pyralid moth **Cryptoblabes gnidiella* Mill. caused damage to flowers of the Oleander. Numerous aduts of the Brachomid parasite *Phanerotoma sp.* were reared from larvae of the moth. (Det. Com. Inst. Ent.).

Solanum tuberosum L. Potato.

The Encyrtid * *Leptomastix dactylopii* How. was bred from the citrus mealy bug *Pseudococcus citri* on potato tubers in the Bermuda laboratory. (Det. Com. Inst. Ent.).

Severe defoliation of potato tops in several fields due to the feeding of the larvae of the Sphingid *Protoparce sexta* Joh. was seen.

ACKNOWLEDGEMENTS.

Acknowledgement is made to the Commonwealth Institute of Entomology and to the Division of Insect Identification, U.S. Department of Agriculture for the identification of insects.

Respectfully submitted,

FRED. D. BENNETT
Acting Plant Pathologist.

January 23rd 1951.

TABLE I.

MONTHLY LIBERATIONS OF PREDATORS AGAINST CARULASPIS VISCI JAN. 1ST. *TO* DEC. 31ST. 1950.

SPECIES	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	TOTALS
CYBOCEPHALUS SP. (origin China)	24,387	66,234	78,509	49,644	5,432	2,011	7,240	5,263	5,859	3,965	—	—	248,544
TELSIMIA SP.	111,186	206,531	178,164	86,976	6,327	27,996	24,233	17,120	5,571	31,139	51,088	5,050	751,581
ZAGLOBA ORNATA	1,096	8,265	28,477	24,700	13,253	26,947	8,965	—	—	—	—	332	112,035
LOTIS NIGERRIMA	2,565	717	343	35,679	49,403	1,525	252	—	—	—	1,124	3,203	94,811
CEPHALOSCYMNUS OCCIDENTALIS	150	—	2,147	11,133	12,660	12,580	2,009	—	—	644	4,580	9,720	55,623
MICROWEISIA SUTURALIS	—	1,263	9,369	11,587	301	—	—	—	—	—	—	—	22,520
CYBOCEPHALUS RUFIFRONS	—	—	—	—	—	2,209	150	—	—	—	—	—	2,359
CHILOCORUS BIVULNERUS	—	—	—	—	—	24	—	—	—	—	—	—	24
CHILOCORUS BIPUSTULATUS	—	—	—	—	—	370	304	808	—	—	—	—	1,482
LINDORUS LOPHANTHAE	—	—	—	—	—	—	1,983	13,031	3,180	8,949	2,265	3,561	32,969
PHAROSCYMNUS EXIGUUS	—	—	—	—	—	—	—	—	—	—	—	272	272
TOTALS:	139,384	283,010	297,009	219,719	87,376	73,662	45,136	36,222	14,810	44,697	59,057	22,138	1,322,220

Monthly Liberations from California Laboratory:	22,782	62,565	99,210	60,469	33,171	41,122	13,534	—	—	644	5,786	14,150	353,433
Monthly Liberations from Bermuda Laboratory:	116,602	220,445	197,799	159,250	54,205	32,540	31,602	36,222	14,810	44,053	53,271	7,988	968,787
													1,322,220

January 8th, 1951.

Report by Dr. J. M. Waterston on a Visit to Bermuda from 24th July to 24th October, 1950, inclusive.

Director of Agriculture:

In offering the following notes made during my brief stay in these Islands, I do so on the understanding that they are observations for the most part only as time has not permitted any very detailed experimental work.

THE BERMUDA CEDARS

The most striking change observed after an absence of three years from the Colony is, of course, the widespread destruction of the Bermuda cedars by the introduced pests *Lepidosaphes newsteadi* and *Carulaspis visci.* It now is apparent that *Juniperus bermudiana* L., is extremely susceptible to injury by these two scale insects — far more so than any of the other known species of juniper. The question now at issue is whether Biological Control measures can reduce the scale infestation to a level which will be non-lethal to the Bermuda cedars, and whether the trees, when this balance is reached will have any horticultural value.

An answer to the first half of the question should be reached by 1952 and it should be possible to decide whether further expenditure on this project is justifiable. There has been a marked decrease in the rate of spread of the juniper scale, *Carulaspis visci,* whether this has been due solely to *Lindorus lophanthae* or to a combination with *Aspidiotiphagus lounsburyi* is not certain. During the next two years, in addition to searching for further predators, some stress should be laid on parasites. Dr. Thompson has already referred to a Diaspis parasite recorded by Dr. Mesnil in Switzerland which prevents the development of the eggs in the female scale insects.

The issues raised in the second half of the question are important. It should be appreciated that Biological Control measures will not eradicate the juniper scale, and that this pest will survive in these Islands as long as there remain any junipers. It is true that the oyster-shell scale, *Lepidosaphes newsteadi* has largely disappeared from Bermuda. This, however, is I believe due to the more successful competition by the juniper scale, *Carulaspis visci,* for the host plant. There are few Bermuda cedars remaining in the oldest areas of infestation of any horticultural value. The few trees which appear to have withstood the scale insect infestation have served to emphasise the extreme susceptibility of the Bermuda juniper to injury from these pests.

Substitutes for the Bermuda Cedar: It will be difficult to find a substitute for junipers in Bermuda, which form a natural self sown forest so well adapted to the Island's soil and climate. The trees have been for

so long a characteristic feature of the Island's vegetation that a strong effort should be made to preserve the Bermudian landscape by including them in the Island's reafforestation programme. Lines of work to be followed which suggest themselves include the selection of Diaspis tolerant strains of Bermuda cedar for propagation and the use of other species of juniper which are Diaspis tolerant and adaptable to the Islands.

Evidence that Diaspis tolerant strains of *Juniperus bermudiana* L., exist has already been found. The trees, however, are few and far between. They should however be multiplied by vegetative propagation. Two other species of juniper, *J. barbadensis* L., and *J. silicicola* (Small) Bailey, do well in Bermuda. The former, particularly, appears in habit very much like the Bermuda cedar and would make an excellent substitute. Care would have to be exercised in obtaining seed and propagating material, as commercial nurserymen are notoriously careless with botanical nomenclature.

J. silicicola would be a most attractive tree for planting around Bermuda cottages. The specimens at present growing in the Islands are not old enough to give an idea of their habit. The Bermuda cedar could however be used as a root-stick for grafting this and other Diaspis tolerant species.

Another possibility is the use of inter-specific hybrids. The seed from the tree at Elba Beach for example will give *barbadensis* X *bermudiana* and might confer Diaspis tolerance with the habit of the Bermuda cedar. This would prove a long term research project however, and the immediate problem can best be answered by replanting with known Diaspis tolerant junipers.

Further work on Biological Control Measures.

The peculiar difficulties associated with Biological Control measures of juniper pests in Bermuda, should not discourage attempts at further work in this field. Bermuda now has a first rate laboratory equipped for this type of work, and many problems still require to be solved, e.g. control of Mediterranean Fruit Fly, Potato Tuber Moth and Oleander Scale. Outbreaks of the latter still occur from time to time, and in view of the emphasis being placed on this shrub in the reafforestation programme, it is essential that its insect pests are studied and effective control measures devised. The other two problems of long standing in the Colony affect fruit growers and farmers. Their solution would be of inestimable benefit to the Islands.

Mediterranean Fruit Fly.

The marked reduction in the incidence of *Ceratitis capitata* in some areas in the Islands, notably, Paget Parish, with records of peaches, loquats, and surinam cherries fruiting without being "stung" suggested an investigation of the parasite status of this pest, particularly with regard to *Opius humilis*, which was introduced for its control in 1926.

Results were disappointing as no parasites were bred from any of the fruit although 307 fruit flies emerged.

Table I showing total emergences of Mediterranean Fruit Fly bred during August-September, 1950.

Host Fruit	No. of fruit	Fly Emergences Total	Per Fruit	Place	Date
Kei-Apple	3	10	3.3	Paget	Aug. 21-25
Fig	1	4	4.0	Devonshire	Aug. 22-Sept. 5.
Grapefruit	2	nil		Paget	July 30.
	2	nil		Smith's	Aug. 14.
	2	nil		Har'ton Sd.	Aug. 18.
	2	nil		" "	Aug. 11.
Lemon, Meyer	6	nil		Paget	July 30.
Peach	12	165	13.7	Smith's	Aug. 25-Sept. 9.
	2	23	11.5	Flatt's	Aug. 29-Sept. 9.
Surinam Cherry	23	4	0.1	Paget	Sept. 12-20.
	14	32	2.2	Har'ton Sd.	Sept. 6-9.
	10	34	3.4	" "	Sept. 11-20.
	25 (¾ ripe)	22	0.9	" "	Sept. 11-20.
	7 (green)	13	1.8	" "	Sept. 11-20.
		307			

It will be observed that a very low incidence of fruit fly was recorded from Surinam cherries in Paget compared with Harrington Sound (Trunk Island), which bears out previous experience earlier in the season. In marked contrast was the high incidence of fruit fly in peaches in Smith's Parish. The undergrowth in the areas where the fruit fly is still abundant in Bermuda is dense. These conditions encourage scale insects and other honey-dew forming pests which enable the fly to carry over from one fruit season to the next. There has been a notable reduction in the population of fidelwood trees in Paget Parish during the last decade. Their disappearance has at the same time removed a dependable source of honey-dew which may be one factor responsible for the reduction in numbers of fruit fly in this neighbourhood.

Another important factor, has undoubtedly been the increased planting of citrus fruit. Lemons and grapefruit appear to act as "Trap Crops", since "stung" fruit do not appear to provide a suitable medium for the development of the larvae. None of the eggs found in the fruit listed in Table I, were found viable after three months, and failed to hatch when transferred to Surinam Cherries.

The factors affecting the survival of the Mediterranean fruit fly in Bermuda deserve to be further studied, particularly from the viewpoint of Biological control.

Black-Tip Disease of Bananas.

Interest in this disease has been revived in recent years by the discovery of various species of moth larvae associated with the decay of the floral parts at the tip of the fruit in the early stages of the disease. It has been suggested that the problem might prove to be an entomological rather than a mycological one.

Careful investigation of the floral parts has revealed that decay of the rind of the banana commences before the flower has fully withered, and that the avenue of entry of the pathogene (a fungus, *Helminthosporium torulosum*) is via the decaying petals. The fungus was isolated, grown in pure culture and its pathogenicity demonstrated by inoculation experiments, thus confirming previous work in Bermuda on the disease by L. Ogilvie.

Four species of moth were found, whose larvae act as scavengers among the detritus of withered banana flowers. The four species found are: *Ereunetis minuscula* Walsm. Family Lyonetidae; *Cryptoblabes gnidiella* Mill. Family Pyralidae; *Pyroderces rileyi* Walsm. Family Cosmopterygidae; *Fundella sp?* (*pellucens*) Zell. Family Pyralidae.

The removal of the banana floral parts with a sharp knife prior to the withering stage was found to prevent black-tip disease in the field. This practice has been carried out in the Canary Islands but whether it would be economically feasible in Bermuda is another question. Perhaps children could be trained to perform the operation.

Spraying would not be an economical method of control. Cultural measures, such as wider spacing between rows to encourage ventilation with more frequent replanting, say every five years, together with proper attention to fertilisation, should give more vigorous plants and less disease. There is little known on control measures but most authors seem to agree that loss of vigour and poor growing conditions favour the disease.

J. M. WATERSTON.

Agricultural Station,
Paget East,
BERMUDA.
24th October, 1950.

Annual Report of the Government Veterinary Officer For the Year 1950.

To: The Director of Agriculture:

In have the honour to submit my Report for the Year 1950.

In order that this report may be as clear as possible each phase of my work as Government Veterinary Officer will be dealt with under its appropriate heading and as concisely as possible.

TUBERCULOSIS CONTROL.

The Board and Department's plan to control Tuberculosis in cattle is by bi-annual testing of all cattle in these Islands, the slaughter under inspection of those animals which react with the payment of compensation to the owners of condemned animals and the quarantine of premises where reactors are found until three clear tests of 60 to 90 days interval have been passed.

During 1950, 1,828 tuberculin tests were carried out; made up as follows:

Privately owned cows	542
Dairy owned cows	643

The dairy cattle were tested twice during the year, but as there have been no reactors in privately owned cattle they were only tested once.

As a result of the test two reactors were found in one herd. The herd, that of Joseph Carvelho, has had a history of Tuberculosis over a number of years and every once in a while a reactor or two turns up.

Two other old cows that came to the slaughter houses showed old calcified lesions. Both of these came from the same herd, another one with a history of an occasional reactor over a number of years.

The Intra-dermal tuberculin test is the standard test used in these Islands and when reactors are found the ophthalmic test is used in connection with it as a check test.

BRUCELLOSIS (BANG'S DISEASE) CONTROL.

The policy followed in this instance is that of calfhood vaccination, that is, all calves that are to be raised are vaccinated with strain 19 Brucella Abortus vaccine between the ages of four to eight months and are bled between sixty to ninety days after vaccination to determine whether or not the vaccination has been successful. If not successful, the calf is re-vaccinated and bled in a further sixty to ninety days.

In addition, any private owner of a cow may, on request, when the animal is being tested for tuberculosis, have its blood tested in order to determine whether or not it is positive and might possibly transmit Undulant Fever in its milk.

During 1950, 108 calves were vaccinated, thus approximately 100 heifers are being raised at the present time.

During the year 13 persons requested that their privately owned cows be blood tested as they were using the milk raw. Of the 13 samples taken 6 were positive and the owners were advised to boil their milk or change their cows. In the case of a heifer that had been vaccinated and the titre was low such a precaution was not so neceessary.

HOG CHOLERA CONTROL.

This control consists of the annual inoculation of all hogs in the Island with anti-hog cholera serum during the Spring months and other inoculations with the same material when an outbreak occurs or is suspected of occurring.

During 1950, 605 hogs were inoculated, these belonging to the larger raisers and as no outbreak of the disease occurred the individually owned pigs were not done.

The great reduction in the hog population in these Islands has lessened this work considerably.

MEAT INSPECTION.

This phase of my activity comes under the direction of the Department of Public Health. The information gathered during the routine inspection of all carcasses coming into the abbatoirs for slaughter gives a very excellent idea of the efficacy of the various tests and control methods.

The various classes of livestock slaughtered and the amount month by month is listed below:—

Month	Cows	Bulls	Calves	Barrows	Sows	Goats
January	5	1	30	130	15	–
February	22	1	34	184	20	–
March	67	3	41	334	8	1
April	15	–	20	87	10	1
May	6	1	19	73	8	–
June	8	1	26	70	20	–
July	14	3	26	85	7	3
August	7	–	21	65	9	–
September	8	–	22	82	10	–
October	8	3	27	86	12	–
November	10	2	29	100	34	–
December	10	4	19	280	49	–
Total:	180	19	314	1,576	202	5

MEAT CONDEMNED.

CATTLE: Total: 4 plucks due to T.B.
1 pluck due to Fibrosis
1 liver due to Abscess
2 quarters due to T. B.

HOGS: Total: 4 heads due to abscess of the submaxilary gland.
35 plucks due to inflamatory changes.
1 liver due to Fibrosis.
1 whole carcass due to Jaundice.

The shortage of imported meat during March was a great aid to dairymen in getting rid of poor producers when 67 head of cattle passed through the slaughter houses.

ANIMALS ADMITTED.

Only animals carrying adequate certificates of health from a proper authority in their country of origin are admitted. In the case of Steamships, I, personally, meet all those carrying animals: while in the case of Aeroplanes, the Inspectors of the Department of Public Health collect the certificates if they are in order and if not the animals are detained until I can be contacted.

Of the livestock admitted, variety was the bye-word, as it ranged from horses to frogs:

Horses	21	
Cattle	37	
Dogs	164	
Cats	9	
Baby chicks	687	cartons
Chickens	45	
Turkeys	1	carton
Rabbits	8	
Monkey	1	
Turtles	2	
Ducks	3	
Pigeons	2	Pair
Guinea pigs	2	
Frogs	1	box (K.E.M.H. LAB.)
Fancy birds	30	

DAIRY INSPECTION.

During my Tuberculin testing of cattle I had an opportunity to see the operation of the dairies as it occurs and this operation was of such a nature that I made a special report to you resulting in considerable discussion, etc. I may state that since Mr. Percy Fisher has been acting as Dairy Inspector for the Board of Health very considerable improvement in the dairy farm has been noted.

I accompanied Mr. Fisher a great many mornings on his inspection to give him any advice that I could.

IMPROVEMENT OF LIVESTOCK.

The three Department owned bulls continue in service at Devonshire Dairy, Pitman Bros. Dairy and Earl Outerbridge's. The bull at Pitman's went temporarily sterile but after using some hormone treatment he improved greatly and is an excellent sire now. The bulls at Pitman's and Devonshire Dairies are in excellent shape but the one at Earl Outerbridge's is extremely thin although a first rate sire.

CERTIFICATES ISSUED.

Seventeen certificates were issued to outgoing animals. As the Departmental policy in regards this is to avoid it as much as possible, no encouragement was given to persons to obtain their certificates from this office.

OTHER DISEASES.

Other diseases such as Mastitis, continue to plague the animals of these Islands, but new methods of treatment are having some effect in cure, but prevention through care and sanitation is not necessary and yet most lacking, generally speaking, in dairy herds especially. In had been hoped to have gone into Mastitis to a considerable extent this summer past, but two or three factors, e.g. poor help in way of a student and no laboratory facilities together with my trip for additional study, made this impossible.

Swine Erysipelas was not seen during the year.

Equine Influenza did not occur except in one new race horse which was immediately segregated, given serum and treated with excellent results.

GOVERNMENT HOUSE HORSES.

The new animals arrived on March 7th. and from the first it was seen that they were not suitable. Several reports re these horses are on file.

Dr. George Cairns, M.R.C.V.S., D.V.M., Assistant Professor of Surgery at the Ontario Veterinary College and an outstanding horseman, visited these Islands and I had him examine them and he agreed with my reports on them.

Until the present they have not improved very much and the larger one continues extremely lazy and is extremely difficult to show, in fact, getting worse all the time.

On Monday, December 4th., "Silver", the remaining one of the old team was humanely put down.

Monthly inspection is made of the team and all other care is given as needed, such as Tetanus antitoxin, etc.

POLICE CALLS.

Five police calls were answered during the year resulting in two court cases with convictions both times.

S. P. C. A.

A new Inspector started at the first of the year and all the help and advice I could offer was given to him. He has proved very successful and my work in connection with cruelty to animals has been at a minimum. The Inspector also helped with the Tuberculin testing.

The opening of the Animals Refuge in Paget has started to remove stray dogs which have been causing considerable havoc among livestock.

PRISON FARM.

With the establishment of H.M. Prison Farm I have on several occasions had to tend to their cattle and hogs.

OTHER NOTES.

Despite much care and attention the imported Goat at Paget Island was lost.

At the request of the Transport Control Board I attended the annual examination of horses and carriages wishing to apply for hire.

On one occasion I had to examine damaged feed for the underwriters.

On one occasion I attended a sick monkey at the Aquarium.

Information on Cattle T.B. was supplied to the T. B. Association at their request.

The student sent to assist me during the summer was not very satisfactory due to insufficient practical knowledge.

My trip to Canada to the Ontario Veterinary College for a Refresher Course was most successful and a report on it has already been forwarded to you.

BLUE BOOK FIGURES.

Livestock Population.

DAIRY ANIMALS:

Cows	Heifers	Bulls	Total
1,080	100	20	1,200

HORSES:

Farm & Truck	Carriage	Race Horses	Total
100	80	60	240

PIGS:

Sows	Boars	Store Pigs	Piglets	Total
200	40	1,300	400	1,940

APPRECIATION.

On the whole the co-operation of the livestock owning public has been good and the help of the S. P. C. A. Inspector much appreciated.

Respectfully submitted,

EDWARD R. EARL, V.S., B.V.Sc.
Government Veterinary Officer.

February 16th. 1951.

Report of the Agricultural Assistant For the Year 1950.

To: The Director of Agriculture:

I herewith submit my report for the year 1950.

ASSISTANCE TO FARMERS.

Cultivation of Land: Many farmers hired the Department's mechanical equipment to assist in their farm operations during the year. A total of 137 acres of land was brought under cultivation by these means.

Spraying: The power sprayer units of the Department were hired out for spraying crops— a total of 3,501 spraying hours divided as follows:

Ground crops	1,023 hours
Citrus trees	2,125 hours
Ornamentals	353 hours

CITRUS CULTURE.

Having been made responsible for servicing of Citrus trees for the Bermuda Citrus Growers Association, I commenced my duties on a part time basis in January. Three inspections of nearly 200 registered Citrus Orchards were carried out during the year, the first in January—February, the second in May and the third in October. During the first and second inspections the trees were sprayed with a combination of Lime Sulphur and Wettable Sulphur at the rate of 7 lbs. of each to one hundred gallons of water in an effort to control the Citrus Rust Mite. While these sprayings were effective in reducing Rust Mite injury there followed a build up of Soft Brown Scale and Sooty Mould marred the appearance of the foliage to some extent. In October all the Orchards were sprayed with Oil Emulsion with the object of cleaning up the scale build up and White Fly.

Cottony Cushion Scale was seen in limited infestations in many Orchards, but there is reason to believe that this scale is kept under control by the ladybird bettle, *Rodolia cardinalis* and there is no reason for spraying with the object of eliminating this scale insect any longer.

During the year 3,053 new trees imported from Florida were added to some existing and new Orchards.

During the year a total of 26,200 gallons of spraying mixtures were applied to the trees. The spray materials used consisted of 3,208 gallons of Lime and Wettable Sulphur and 82 gallons of Oil Emulsion.

Fertilizer totalling 23,624 lbs. consisting of a mixture of organic and chemical elements analyzing 4½% nitrogen, 8% Phospheric Acid, and 7% Potash was applied to the trees in three applications.

An Exhibition of Citrus fruit sponsored by the Bermuda Citrus Growers Association was staged at the Agricultural Station on 14th., 15th. and 16th. December. This Exhibition brought together a large and varied selection of citrus fruit which was much admired by a large number of people and did much to stimulate further interest in Citrus Culture.

Respectfully submitted,

C. V. S. EARLY,
Agricultural Assistant.

January 20th. 1951.

Report of the Government Marketing Officer For the Year 1950.

To: The Director of Agriculture:

I have the honour to submit a report on the Cold Storage Plant and the activities of the Marketing Centre during the year.

The volume of business transacted through the Marketing Cen tre during the year was the greatest ever. Purchases of vegetables and other ground crops amounted to £23,563. 9. 2., exceeding that of the previous year by £9,225 17 8.

This increase was brought about by the inauguration of "Planned Production and Marketing" during the previous year, which guaranteed to the farmers' minimum prices for the basic crops with an opportunity to use their own discretion in respect of commodities not provided for in the agreement.

The following quantities of vegetables and Bananas were purchased from Farmers:

Bananas	20,982 lbs.	Onions, bunches	218 doz.
Beans	15,277 "	Parsley bunches	149 "
Beets	4,100 "	Peppers	816 "
Broccoli	5,926 "	Potatoes, Irish	483,300 lbs.
Cabbage	67,568 "	Potatoes, Sweet	62,646 "
Canteloupes	4,649 "	Pumpkin	28,849 "
Carrots	88,823 "	Radish	93 doz.
Cauliflower	11,051 "	Spinach	1,824 lbs.
Celery	10,850 "	Squash	4,360 "
Corn	1,025 doz.	Strawberries, bskts.	2,476 "
Cucumbers	226 "	Tomatoes	109,839 lbs.
Eggs	2,137 "	Turnips	11,855 "
Lettuce	1,484 "	Watermelons	11,427 "
Onions	31,942 lbs.		

In addition to the above, fifteen other miscellaneous fruits and vegetables were purchased.

COMMENTS ON COMMODITIES PURCHASED.

Tomatoes: This was the most valuable crop handled. It was second only to potatoes in volume and supplies were available during every month of the year as the following record of receipts will show:

Purchase of Tomatoes from Farmers:

January	18,501 lbs.	July	3,315 lbs.
February	16,461 "	August	1,212 "
March	11,078 "	September	2,095 "
April	9,685 "	October	2,677 "
May	19,567 "	November	723 "
June	15,794 "	December	8,478 "

During the months of May and June the supply of tomatoes exceeded the demand to some extent resulting in the loss of about 2,000 lbs. of the fruit from deterioration. I am of the opinion that a separate chillroom where a temperature of 50°F. could be maintained would be beneficial for storing tomatoes to minimize the loss from over ripeness during times of over production.

Cabbage: This vegetable did not stand up well under refrigeration during the months of December, January and February and a loss was incurred from deterioration while in storage. This deterioration in cabbage may be the result of using too much nitrogenous fertilizer to force growth.

The sale of cabbage was more restricted than the previous year due to the fact that the U. S. Bases personnel did not make any purchases of cabbage this year.

Carrots: This vegetable kept very well under refrigeration this year and there was little loss from deterioration. The supply of this vegetable was a little in excess of the local market requirements during April, May and June, but this congestion was relieved by exportations to Trinidad.

Potatoes: The Marketing Centre purchases of potatoes exceeded that of 1949 by 4,080 bushels. The potato tuber moth made its appearance as usual in the late Spring and a few farmers suffered loss due to the depredations of the moth. Tubers slightly infected with the moth were promptly under refrigeration at 35°—38°F. and they were marketed without loss several weeks afterwards. Unfortunately, the existing chill accommodation is too small to permit the free use for potato storage during the late Spring and Summer months when the potato tuber moth is most active.

Outlets for Vegetables: Hotels proved a good source of demand for Bermuda vegetables compared with previous years. The United States Bases personnel also made heavy purchases of carrots, melons, and tomatoes which business was much appreciated. Local businesses patronized the Marketing Centre very well this year which resulted in a wider distribution of Bermuda vegetables than ever before.

Refrigeration Plant: The six separate compressor units which supply the refrigeration to as many rooms functioned satisfactorily throughout the year with only minor troubles.

General: In common with the general trend of labour conditions, difficulties were experienced in securing competent labour and at times the efficient operation of the plant was affected thereby.

Mr. Carlyle Hollis, who was appointed Assistant Marketing Officer at the beginning of the year proved a valuable asset to the Department and he was a great help to me to carry out the exacting duties which the work entails.

Difficulties were encountered in selling vegetables produced from unsuitable seed. This trouble was particularly applicable to cabbage and carrots and I suggest that steps be taken to remedy the situation.

I wish to record my appreciation to the loyal farmers who joined the programme of "Planned Production and Marketing" and carried out the provisions of the scheme with reasonable care. The farmers who planted land in excess of the acreage specified in their contracts and sold their produce outside of the legitimate market were happily in the minority and their activities proved no more than an aggravating situation.

Respectfully submitted,

JAMES H. HOLLIS,
Marketing Officer.

February 10th. 1951.

Report of the Acting Accountant For the Year 1950.

To: The Director of Agriculture:

I have the honour to submit the following report for the year 1950.

1. The statistics etc., that are attached, have been compiled from records kept at the Department of Agriculture for both the Department and the Marketing Centre.

2. To the best of my knowledge all books have, at all times during the year, been correctly entered and all monies properly accounted for.

3. During the year 1950 no examination was made by the Audit Department of this Department's records.

4. It will be seen in Appendix "A" that the volume of business for the Department has greatly increased in 1950. The reason for this being obviously the increased activity on reafforestation work. The Marketing Centre likewise shows a great expansion in the volume of business.

5. Appendix "B" shows the total expenditure for the year 1950. This shows an increase over 1949 but is in keeping with increased activities.

6. Appendix "C" shows the breakdown of revenue, etc. for the Marketing Centre.

7. Appendix "D" is the profit and loss statement of the Marketing Centre as compiled by myself; this is subject to verification by the Colonial Auditor, however, accepting this as correct it will be seen that a gross profit of £333 15 0 was made on sales and £593 15 10 was made on Cold Storage earnings. This, however, does not give the true picture, as certain charges have not been recorded in the Profit and Loss statement, and were made as direct charges from votes.

APPENDIX "A"

SUMMARY OF RECEIPTS FOR YEAR 1950.

Vote 2. (a)	Packing House			708	7	2		
2. (b)	Marketing Centre			24,463	16	4		
2. (c)	Service to Citrus Growers			458	9	6		
2. (d)	Other Receipts			11,321	11	4	36,952	4 4

The following is a breakdown of the above:—

Vote 2. (a)	Sale of Crates			708	7	2		
2. (b)	Sale of Vegetables at Marketing Centre			24,463	16	4		
2. (c)	Service to Citrus Growers			458	9	6		
2. (d)	Hire of Equipment			506	10	3		
	Sale of Plants, etc.			2,342	4	10		
	Sale of Citrus Trees			821	10	6		
	Sale of Fertilizer			14	2	0		
	Reafforestation Work			7,543	16	9		
	Miscellaneous			93	7	0		
MEMO:	(Reinbursements — 315.18. 1.) (Suspense Account — Portuguese Labour — 360 0 0)			...	...	...	36,952	4 4

APPENDIX "B"

EXPENDITURE FOR PERIOD JANUARY 1ST. TO DECEMBER 31ST 1950.

Vote:	Service:	Amount of Vote:	Expenditure:	Balance Lapsing:
1	Fee to Members of Board	100 0 0	42 0 0	58 0 0
2-4, 6-11	Salaries	7198 0 0	5693 8 5	1504 11 7
5	Personal Allowance to E. C. G. Bedford	300 0 0	168 11 0	131 9 0
12-15.	Salaries	2654 0 0	2418 0 1	235 19 11
16	Extra Clerical Assistance	500 0 0	286 11 8	213 8 4
16A.	Bonus to Civil Servants	540 0 0	426 7 2	113 12 10

Vote:	Service:	Amount of Vote:	Expenditure:	Balance Lapsing:
16B.	Bonus to other Employees	237 0 0	216 6 11	20 13 1
17	General Grant	3500 0 0	3463 9 7	36 10 5
18	Control of Animal Diseases & Improvement of Livestock	1810 0 0	1790 10 2	19 9 10
19	Control of Plant Diseases and Pests	500 0 0	448 8 3	51 11 9
20	Horticulture	2850 0 0	2848 16 6	1 3 6
21	Government House Gardens	2300 0 0	2283 16 9	16 3 3
22	Departmental Contingencies	400 0 0	330 5 6	69 14 6
23	Packing House and Market Investigation	1000 0 0	975 8 0	24 12 0
24	Cold Storage . Plant Operation	2000 0 0	1688 4 4	311 15 8
25	Purchase, Upkeep & Operation of Agricultural Equipment	3900 0 0	3870 0 6	29 19 6
26	Purchase and Storage of Agricultural Supplies	500 0 0	475 12 1	24 7 11
27	Purchase and Storage of Potatoes etc. for resale	30000 0 0	24392 10 3	5607 9 9
28	Agricultural Scholarships	400 0 0	400 0 0	nil.
29	Agricultural Exhibition	1000 0 0	992 10 5	7 9 7
30	Biological Control of Insects of Importance in Bermuda	24000 0 0	16783 17 10	7216 2 2
31	Reafforestation and Roadside Planting	38000 0 0	37998 11 4	1 8 8
32	Service to Citrus Growers	1500 0 0	1498 4 1	1 15 11
33	Publications	250 0 0	176 17 7	73 2 5
34	Agricultural & Horticultural Extension Work	500 0 0	497 10 8	2 9 4
35	Return passage for E. C. G. Bedford and Family	784 12 3	784 12 3	nil.
36	Government Chill Room	1250 0 0	905 9 9	344 10 3
		127,973 12 3	111,856 1 1	16,117 11 2

APPENDIX "C"

VOLUME OF BUSINESS RECORDED AT GOVERNMENT MARKETING CENTRE DURING 1950.

Month	Sales	Cold Storage	Purchases
January	2,333 11 11	32 11 9	3,217 5 5
February	2,312 10 8	18 15 6	2,370 8 4
March	2,560 18 0	85 11 3	1,738 18 6
April	1,933 17 3	40 9 8	2,369 3 11
May	1,970 11 4	16 18 3	5,226 12 6
June	2,144 14 1	14 10 0	2,580 16 9
July	4,402 6 1	213 7 6	1,371 14 9
August	2,354 16 1	158 2 3	582 15 10
September	946 1 8	52 15 0	768 13 7
October	668 2 2	39 12 9	571 11 8
November	865 7 3	27 4 2	991 13 6
December	1,414 2 5	16 17 9	1,773 14 5
	23,906 18 11	716 15 10	23,563 9 2
		# 123 0 0	
	23,906 18 11	593 15 10	23,563 9 2

Less allowance made to customer authorized by Col. Sec. dated December 29, 1949.

APPENDIX "D"

Government Wholesale Marketing Centre:		Profit & Loss Statement for year 1950.	
To Stock, January 1, 1950	437 9 10	By Sales	23,906 18 11
To Purchases	23,563 9 2	By Stock, December 31, 1950	427 15 1
To Gross Profit C/D	333 15 0		
	24,334 14 0		24,334 14 0
To amount Transferred to Treasury Account	24,491 0 0	By Gross Profit B/D	333 15 0
		By Cold Storage Sales	593 15 10
			927 10 10
		By Government Grant	23,563 9 2
	24,491 0 0		24,491 0 0

AMY DeSILVA,
Acting Accountant.

February 22nd, 1951.